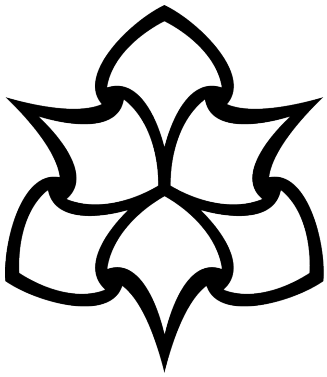

The Folly of a Normative Account of "Constructivist Agents"

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Upshot: The target article is criticised on four counts. It fails to make clear what is meant by the phrase "constructivist agent," and whether the author is trying to *define* "constructivist agent" or arguing what the minimal criteria for this are (there are problems with either). It does not make clear whether weak or strong emergence is intended (there are problems with either). The arguments for a minimal level of granularity are incoherent. To summarise, the whole project has a normative flavour that seems odd given the constructivist stance it intends to argue from.

What is a "constructivist agent"?

1. Manfred Füllsack's target article presents an account of "constructivist agents," to establish a "…minimum set for conceiving an artificial constructivist agent: these are (a) the multitude criterion as mentioned above, which, as I see it, necessitates (b) a minimum plasticity of the agents, and (c) a minimum granularity of the stuff that agents consist of." (§3)

2. However, what is not clear is in which direction Füllsack is arguing. There seem to be two possibilities for this, namely that the article is an attempt…

- to define what "constructivist agents" *are* (i.e. they are those agents that satisfy the three criteria above);
- to show that those three criteria are the *necessary* conditions for a "constructivist agent."

So, which of the above possibilities did the author intend? (Q1)

3. If the intention is the former, then the question naturally arises as to why anyone should accept Füllsack's definition, since he does not establish any criteria for the "goodness" or purpose of the definition. For example, he does not argue that this will result in agents that are more useful, nor does he argue that such agents would be better representations of anything observed. In this case, the definition floats in a kind of limbo without apparent purpose or a particular role.

4. If the intention is to argue for the necessity of the three conditions, then we also need to know how to judge whether an agent is "constructivist" or not in order to be able to tell whether these conditions are, in fact, necessary. The text gives only one hint at this, namely that their agency is not programmed in, but *emerges* during a complex process of interaction with other agents. However, this merely shifts the argument to the

nature of emergence and agency. Unfortunately, neither of these concepts is defined in the target article. How do we know whether an entity has agency? How do we know if something is built-in or emerges?

5. Constructivism is a philosophical position. The whole idea of labelling an entity that we either build or observe as "constructivist" does not make obvious sense, because constructivism is a way of thinking about the nature of knowledge and not a property of any *thing*. I *guess* Füllsack simply means that the agency was not designed but emerged, but (a) this has not been clearly stated and (b) very simple things can emerge from such processes, many of which could not be said to have any agency at all (e.g., mathematical solutions found via a co-evolutionary genetic programming algorithm). What kind of emergence does the author intend? (Q2) This suggests the question concerning what precisely Füllsack means by a "constructivist agent" (assuming that it is not defined by his three criteria – is identical with a "minimal artificial constructivist agent" – which would make the argument circular)?

Misunderstanding emergence

6. There are a number of kinds of emergence discussed in the literature, of which the most prominent are:

- *Strong emergence*, where the emergent properties are not reducible to those of the component parts (Laughlin 2005), even in principle.
- *Weak emergence*, where new properties do arise but can be determined by simulating the system (though where no short-cuts to doing the simulation are sufficient) (Bedeau 1997).

7. It would seem that Füllsack is not talking about strong emergence, since he gives an example of a simulation that is, in principle, reducible to many small knowable computational steps (if the random seed of the simulation is known). If he is talking about weak emergence, then the macro-level framework for describing the new properties is very important (this being different from the framework or language that describes the micro-level properties). However, this macro-level framework is not specified – indeed it appears from the text that the author has not considered this. Given the lack of communicated purpose or role for this definition one cannot but suspect that Füllsack has effectively adopted an essentialist view of emergence, due to his wish to specify what a "constructivist agent" *should* be (see section below).

Why is agent granularity necessary?

8. In §10, Füllsack asserts that a minimum level of component granularity is necessary for the emergence of "constructivist agents" but does not give a convincing reason why. Why is it not possible that the agents in the example could have had a much simpler learning algorithm than an artificial neural network (ANN)? The same kind of processes could take place, the same kind of outcomes could emerge. In the lack of a clear account in the target article, I can only presume one of two reasons:

- It is somehow essential that the agents adapt via learning and interaction processes that utilise floating point numbers rather than discrete symbols;
- It is the complexity of the mechanisms inside the agents that is important.

9. Given that floating point representations can be arbitrarily approximated using discrete symbols (as in the case of floating point representations in digital computers) and that digital symbols can be effectively implemented using continuous values with arbitrarily low levels of error (as occurs in computer chips), this cannot be an essentialist argument – neither discreteness nor continuity is fundamental (Edmonds 1999). This leads me to conclude that it is the second reason. However, what would be a necessary minimum amount of complexity in agents for it to count as emergence? I suspect that, due to the cognitive limitations of human cognition, if the agents are sufficiently complicated, the results can appear emergent just because the process is not transparent to us. If this is the case, then the level of granularity is not well-defined and is just relative to our cognitive capabilities, which would mean that if we were more stupid, then simpler agents would be acceptable. If this is right, that the *mysteriousness* of the agent decision is important, the author should make this clear. If this is not the right explanation, this suggests the question of exactly *why* any particular level of granularity is necessary for the emergence of "constructivist agents"? (Q3)

10. If the level of necessary granularity is arbitrary and the issue of continuous vs. discrete computation is irrelevant, then there is no particular reason to agree with the claim that "the working principle of ANNs substantiates the claim of constructivism" (§50). Indeed, his whole argument is that it is interaction within a set of other entities that allows such agency, which is not the case with many ANNs. Whether something is an ANN or another kind of algorithm (e.g., genetic programming) is irrelevant to either the issue of emergence or that of agency.

Normative accounts of agents

11. All of the above deficiencies: the lack of argumentative direction, the lack of clarity about what is intended here by "emergence," the arbitrary nature of the granularity claimed necessary, rule out other interpretations of Füllsack's intentions here. This leaves us with what I call "the folly," of attempting a normative account of what a "constructivist agent" should be, e.g., when, in §47, Füllsack says "Constructivist agents *should* be conceived as emerging…" (my emphasis). Quite apart from the fact that the phrase "constructivist agent" is an oxymoron (as I pointed out in §5), this is a puzzle. On what basis does the author claim this deontic? Is there a moral issue here? Is this acase where other kinds (definitions) of agents are less good for some task or goal? The approach claimed is very different from the standard definition of an agent (Wooldridge & Jennings 1995). Surely, if I am a constructivist, I believe there is some creative process involved in the expression and development of knowledge. Why should I be constrained, without good reason, into how I conceive of any kind of agent? (Q4)

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